Brief anger may impair blood vessel function, says new research

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A brief episode of anger triggered by remembering past experiences may negatively impact the blood vessels' ability to relax, which is essential for proper blood flow, according to new research published in the *Journal of*
Previous research has found that impairment of blood vessels' ability to relax may increase the risk of developing atherosclerosis, which may in turn increase the risk of heart disease and stroke.

"Impaired vascular function is linked to an increased risk of heart attack and stroke," said lead study author Daichi Shimbo, M.D., a professor of medicine at the Columbia University Irving Medical Center in New York City. "Observational studies have linked feelings of negative emotions with having a heart attack or other cardiovascular disease events. The most common negative emotion studied is anger, and there are fewer studies on anxiety and sadness, which have also been linked to heart attack risk."

In this study, the researchers investigated whether negative emotions—anger, sadness and anxiety—may have an adverse impact on blood vessel function compared to a neutral emotion. The 280 adults in the study were randomly assigned to one of four emotional tasks for 8 minutes: recalling a personal memory that made them angry; recalling a personal memory of anxiety; reading a series of depressing sentences that evoked sadness; or repeatedly counting to 100 to induce an emotionally neutral state.

This protocol, "Putative mechanisms Underlying Myocardial infarction onset and Emotions (PUME)," was described by the researchers in a previous paper.

Researchers assessed the cells lining each study participant's blood vessels before the tasks and at several points after, looking for evidence of impaired blood vessel dilation, increased cell injury and/or reduced cell repair capacity. The measurements taken before the emotional tasks were repeated after tasks were completed.
Measurements were taken for each participant at baseline (0 minutes) and at four different timepoints after experiencing the assigned emotional task: 3 minutes, 40 minutes, 70 minutes and 100 minutes. The analysis found:

- Tasks that recalled past events causing anger led to an impairment in blood vessel dilation, from zero to 40 minutes after the task. The impairment was no longer present after the 40-minute mark.
- There were no statistically significant changes to participants' blood vessel linings at any time points after experiencing the anxiety and sadness emotional tasks.

"We saw that evoking an angered state led to blood vessel dysfunction, though we don't yet understand what may cause these changes," Shimbo said. "Investigation into the underlying links between anger and blood vessel dysfunction may help identify effective intervention targets for people at increased risk of cardiovascular events."

According to an American Heart Association 2021 scientific statement, "Psychological Health, Well-Being, and the Mind-Heart-Body Connection," mental well-being can positively or negatively impact a person's health and risk factors for heart disease and stroke.

"This study adds nicely to the growing evidence base that mental well-being can affect cardiovascular health, and that intense acute emotional states, such as anger or stress, may lead to cardiovascular events," said Glenn Levine, M.D., FAHA, writing committee chair of the scientific statement, and master clinician and professor of medicine at Baylor College of Medicine, and chief of the cardiology section at the Michael E. DeBakey VA Medical Center, both in Houston.

"For instance, we know that intense sadness or similar emotions are a
common trigger for Takatsubo cardiomyopathy, and events such as earthquakes or even as a fan watching a world soccer match, which provoke stress, may lead to myocardial infarction and/or to arrhythmias.

"This current study very eloquently shows how anger can negatively impact vascular endothelial health and function, and we know the vascular endothelium, the lining of blood vessels, is a key player in myocardial ischemia and atherosclerotic heart disease. While not all the mechanisms on how psychological states and health impact cardiovascular health have been elucidated, this study clearly takes us one step closer to defining such mechanisms."

Study background and details:

- The Putative mechanisms Underlying Myocardial infarction onset and Emotions (PUME) study is a randomized controlled experimental study conducted from August 2013 to May 2017.
- Participants were recruited from the community surrounding Columbia University Irving Medical Center in New York City.
- Participants were ages 18 or older and healthy. In this study, healthy was defined as no history of heart disease, stroke, bypass surgery or stents, transient ischemic attack, peripheral arterial disease, heart failure, high blood pressure, high cholesterol, Type 2 diabetes or self-reported diagnosis of a mental health disorder; not taking any prescription medications or dietary supplements; and not currently smoking.
- The average age of study participants was 26 years. Approximately 50% of participants self-identified as women. About 40% of participants self-identified as white adults; 29% as Hispanic/Latino adults; 19% as Asian adults; and 14% as Black adults.
- Participants' blood vessel health was assessed before and after completing the emotional tasks with finger probes that detect
changes in blood flow in arteries.

- Before completing the emotional tasks, participants were seated in a comfortable chair in a temperature-controlled room and instructed to relax for 30 minutes, during which time they were not allowed to talk, use their phones, read any documents or sleep.
- After the participants had relaxed for 30 minutes, researchers measured participants' blood pressure with a cuff and corresponding heart rate. Two blood pressure measurements were taken one minute apart, then the dilation of participants' blood vessels was measured, and blood samples were collected for testing. Repeat measurements of blood pressure and dilation were conducted, and blood samples were collected again after the assigned emotional task was completed.
- Researchers determined the extent to which participants' blood vessels were unable to dilate by measuring the blood flow in the participants' non-dominant forearm. They assessed the injury to participants' blood vessels by counting the number of circulating blood vessel lining biomarkers in the blood and assessed the regenerative ability of participants' vascular cells by measuring their circulating levels of bone-marrow-derived cells, which are essential for repair.

The study's limitations included that participants were young and apparently healthy, "making it unclear whether the results would apply to older adults with other health conditions, who would most likely be taking medications," Shimbo noted. In addition, participants were observed in a health care setting, rather than in real-world situations, and the study only assessed the short-term effects of evoked emotions.

More information: Journal of the American Heart Association (2024).